REMARKS

Claims 3, 7-18 are pending. Claims 3, 7 and 14 are amended herein. Claim 4 is cancelled. Claims 5-6 are currently withdrawn from consideration.

At page 2 of the Office Action, the Examiner rejects Claim 3 under 35 U.S.C. §112, ¶1, claiming there is insufficient support in the specification for the limitation requiring "continuing to apply pressure to the composite mat while cooling the same." However, Applicant respectfully submits, that position is incorrect because there is ample support in the specification for this limitation.

In particular, Fig. 5, reproduced below, shows cooling zones C100 and C200 in a system according to the invention, including magnet rollers C110 cooled for foaming the composite mat, and cooling rollers C120. (*See* specification, page 19, lines 26-28).

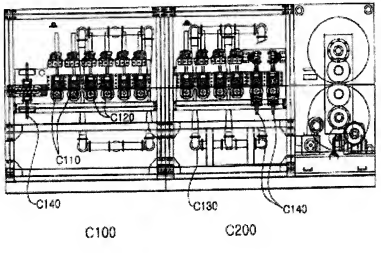


Fig. 5

As shown, the rollers C110 and C120 comprise upper and lower rollers having the same or similar configuration as the rollers in the compressing zones B100, B200, B300, shown in Fig. 4, reproduced below:

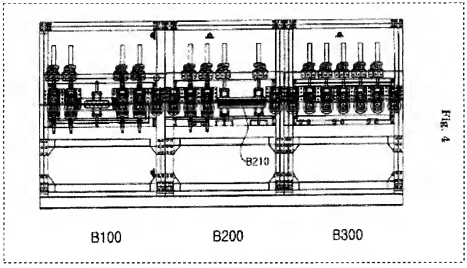
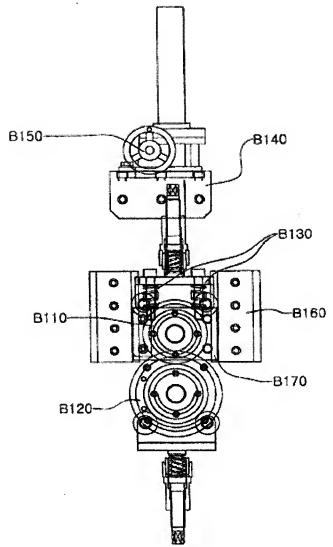


Fig. 6, reproduced below, shows this configuration of upper and lower rollers in more detail:

Fig. 6



In Fig. 6, springs B130 are mounted to apply constant tension to the upper and lower rollers B110, B120. (*See* specification, page 21, lines 22-26). A controller applies pressure to the rollers, and hence the composite mat passing through the rollers, by the pressure of the springs. (*Id.* at page 21, lines 26-28). The tension of the springs in one embodiment is set according to Table I, reproduced below:

TABLE 1
Relation of Thickness and Spring Tension
(Final Thickness: 3 mm)

	Pre-heating Zone	1st Compress. Zone	2nd Compress. Zone	3rd Compress. Zone	1st Cooling Zone	2nd Cooling Zone
Thick.(mm)	50	35 | 13	11 | 9 | 5	3.5 | 3.3 | 3.2	3.15 | 3.1	3.05 | 3.0±0.2
Spring (kgf/cm^2)		60	150	200	150	150
Belt Surface(°C)	200	230	230	220	150 | 90	70 | 50

(*Id.* at page 16, lines 24-30).

As indicated in Table I, in this embodiment, the springs for the rollers in both the first cooling zone C100 and the second cooling zone C200 are configured to apply a pressure of 150 kgf/cm^2, the very same pressure as applied by the rollers in the second compressing zone B200.

Based on the foregoing, it can be seen that there is ample support in the specification for the limitation of Claim 3 requiring "continuing to apply pressure to the composite mat while cooling the same." Accordingly, the Examiner is respectfully requested to withdraw the 35 U.S.C. §112, ¶1 rejection of Claim 3.

At page 2 of the Office Action, the Examiner rejects Claim 7 under 35 U.S.C. §112, ¶1, claiming there is insufficient support in the specification for the limitation "matrix fibers" and the limitation requiring "compressing while cooling the composite mat."

The 35 U.S.C. §112, ¶1 rejection of Claim 7 based on the "matrix fibers" limitation is considered to have been mooted by the amendment adding "thermoplastic" to Claim 7. Moreover, the 35 U.S.C. §112, ¶1 rejection of Claim 7 based on the "compressing while cooling the composite mat" limitation is considered to have been overcome by the previous discussion regarding Claim 3, showing the support in the specification for the limitation requiring "continuing to apply pressure to the composite mat while cooling the same." The same portions of the specification supporting this limitation as discussed above are also considered to provide support for the "compressing while cooling the composite mat" limitation of Claim 7.

Based on the foregoing, the Examiner is respectfully requested to withdraw the 35 U.S.C. §112, ¶1 rejection of Claim 7.

At pages 2-3 of the Office Action, the Examiner rejects Claim 14 under 35 U.S.C. §112, ¶¶1, 2, claiming there is insufficient support in the specification for the recitation "or more," and also claiming this recitation renders the claim indefinite. These rejections are considered to have been overcome by the amendment to Claim 14, removing the "or more" recitation.

At pages 3-4 of the Office Action, the Examiner rejects Claims 3, 4, 7, 10 and 12 for lack of novelty over Bastioli, and, at pages 4-6, rejects Claims 8, 9 and 11 for obviousness over Bastioli as the base reference in view of other secondary references. Pages 6-7 indicate the Examiner considers the thermoplastic polymer granules described in Bastioli to correspond to the claimed thermoplastic fibers, and the formation of the claimed pseudo-foamed composite sheet to be inherent in Bastioli. However, both of these positions are, Applicant respectfully submits, incorrect.

The first position, that the thermoplastic polymer granules of Bastioli correspond to the claimed thermoplastic fibers, is incorrect because the specification, the claim language, the teachings of Bastioli, and the ordinary meaning of "granule," all show that the thermoplastic granules of Bastioli do not correspond to the claimed thermoplastic fibers because they are incapable of entangling the reinforcing fibers as required.

In particular, the specification clearly teaches that the thermoplastic fibers must entangle the reinforcing fibers in order to form the pseudo-foamed composite sheet required by the claims. (*See* specification, page 15, lines 18-30; page 20, lines 4-6). Absent this entanglement, the specification teaches, the thermoplastic polymer will separate from the reinforcing fiber, and give rise to poor properties in the ensuing end product. (*Id.* at page 2, lines 21-27).

The claims also require this entanglement. Claim 1 expressly recites this, as follows:

> "wherein a pseudo-foamed composite sheet is formed by increased resilience of the reinforcing fiber due to entanglement of the mutually combined fibers. . . . " (Emphasis added).

So does Claim 7, as follows:

> "wherein a pseudo-foamed, fiber-reinforced composite is formed due to entanglement of the mutually combined fibers. . . ." (Emphasis added).

Thus, the specification and claims both define the thermoplastic fibers in a way that requires that they be capable of entangling the reinforcing fibers.

However, the granules of Bastioli are incapable of entangling the reinforcing fibers as required to form the claimed pseudo-foamed composite sheet. Bastioli unequivocally teaches that the thermoplastic polymer is "in the form of granules." (*See* Bastioli, Col. 3, line 59). The ordinary meaning of "granule" is "a small particle." (*See* Merriam-Webster's Collegiate Dictionary, Eleventh Edition, 2003, page 545). There is nothing in Bastioli that suggests that these granules deviate from this ordinary meaning, as the Examiner claims. Thus, the thermoplastic granules of Bastioli do not correspond to the claimed thermoplastic fibers because they are incapable of entangling the reinforcing fibers as required.

Although Bastioli teaches, at Col. 3:59, that the preferred shape of the granules is "cylindrical," and also teaches, at Col. 3:62-63, that either the height or diameter of this cylinder will vary from 0.1 to 10 mm, Bastioli does not state that the height and diameter can independently vary to achieve an aspect ratio of 100, as the Examiner concludes, as would be required to deviate from the ordinary meaning of "granule." Moreover, at Col. 3:64, Bastioli teaches that the "optimum" size is between 2 to 4 mm, and also teaches, at Col. 3:60-62, that this size is "very important in order to achieve . . . good penetration of the matrix into the interstices of the reinforcing structure." That obviously shows that these granules, even given the possible variations, fit within the interstices of the reinforcing fibers, which renders them incapable of achieving the requisite entanglement with the reinforcing fibers.

In sum, since the specification and claims require that the thermoplastic fibers be capable of entangling the reinforcing fibers, and the granules of Bastioli are incapable of meeting this requirement given the teaching of Bastioli that it important that they fit within the interstices of those fibers, it would be incorrect to conclude these granules correspond to and meet the claimed thermoplastic fibers.

The second position, that Bastioli inherently teaches the formation of the claimed pseudo-foamed composite sheet, is likewise incorrect. Because the thermoplastic granules of Bastioli are incapable of entangling the reinforcing fibers, as discussed above, any mixture of these granules and fibers would be incapable of forming the claimed pseudo-foamed composite sheet based on the teachings of the specification that this entanglement is a necessary predicate for the formation of this pseudo-foamed sheet. For example, page 20, lines 4-6, of the specification teaches that "entanglement of the mutually combined fibers leads to increased resilience required to foam the composite sheet." (Emphasis added). Page 15, lines 18-30 contains a similar teaching. Based on these teachings, the formation of a pseudo-foamed composite sheet is not inherent in Bastioli.

Therefore, Bastioli does not meet at least the following limitations of Claim 3:

> "fibrillating thermoplastic fibers and reinforcing fibers;
>
> combining the fibrillated thermoplastic fibers and reinforcing fibers to form combined fibers;
>
> * * *
>
> wherein a pseudo-foamed composite sheet is formed by increased resilience of the reinforcing fiber due to entanglement of the mutually combined fibers. . . ." (Emphasis added).

Nor does it meet at least the following limitations of Claim 7:

> "fibrillating thermoplastic matrix fibers and reinforcing fibers;
>
> combining thermoplastic matrix fibers and reinforcing fibers to form combined fibers;
>
> * * *
>
> wherein a pseudo-foamed, fiber-reinforced composite is formed due to entanglement of the mutually combined fibers. . . ." (Emphasis added).

Furthermore, the claims, as amended, recite additional features that are neither taught nor disclosed by Bastioli, or any of the secondary references.

More specifically, Claim 3, as amended, recites certain features, underlined below, relating to instantaneously decreasing pressure applied to the mat, the use of a continuous belt to convey the mat, and the gradual decrease in the intervals between upper and lower rollers applying pressure to the belt:

> "wherein a pseudo-foamed composite sheet is formed by increased resilience of the reinforcing fiber due to entanglement of the mutually combined fibers when the pressure is instantaneously decreased;
>
> wherein the composite mat is conveyed by a continuous belt, with pressure being applied to the belt by upper and lower rollers; and
>
> wherein intervals between the upper and lower rollers are gradually decreased." (Emphasis added).

Claim 7, as amended, recites the feature relating to instantaneously decreasing the pressure applied to the mat:

"wherein a pseudo-foamed, fiber-reinforced composite is formed due to entanglement of the mutually combined fibers when pressure applied to the mat is instantaneously decreased." (Emphasis added).

These amendments, which are supported by page 15, lines 23-30 of the specification, are neither taught nor suggested by Bastioli or any of the secondary references.

In sum, the thermoplastic granules of Bastioli do not correspond to the claimed thermoplastic fibers because they are incapable of entangling the reinforcing fibers as required. Moreover, Bastioli does not inherently disclose the formation of a pseudo-foamed composite sheet because the thermoplastic granules of Bastioli are incapable of entangling the reinforcing fibers as required to form this pseudo-foamed composite sheet. Furthermore, neither Bastioli nor any of the secondary references teach or disclosure any of the amendments relating to instantaneously decreasing pressure applied to the mat, the use of a continuous belt to convey the mat, and the gradual decrease in the intervals between upper and lower rollers applying pressure to the belt

For all the foregoing reasons, the lack of novelty rejection of Claims 3, 7, 10 and 12 should, Applicant respectfully submits, be withdrawn. Moreover, the obviousness

rejection of Claims 8, 9 and 11 should also be withdrawn because nothing recited in any of the secondary references fills the gaps in teaching of Bastioli. Claims 3, 7-12 are therefore allowable over Bastioli and each of the secondary references, considered singly or in combination.

Conclusion

For all the foregoing reasons, reconsideration of and withdrawal of all outstanding rejections is respectfully requested. The Examiner is earnestly solicited to allow all claims, and pass this application to issuance.

To expedite allowance of this case, the Examiner is earnestly invited to call Robert C. Laurenson at (949) 759-5269.

Respectfully submitted,

Date: November 8, 2007

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